DOG BREED CLASSIFICATION

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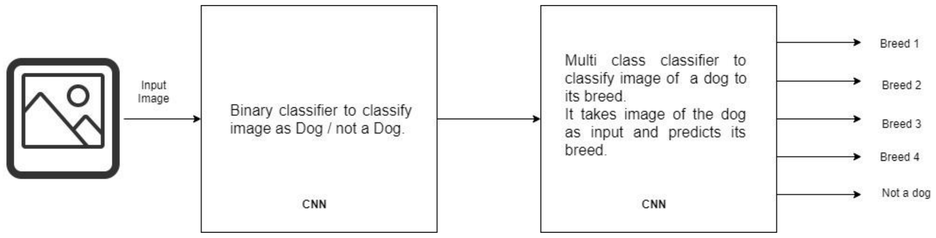
Abstract

- Project uses machine learning techniques to predict dog breeds from images of dogs.
- Dog breed classification is a very specific application of convolutional neural networks. It falls under the category of fine-grained image classification problem.
- The user will specify an image as input to the model and it will detect if it is a dog or not. If a dog is detected in the image, the model will further classify the breed of the dog.

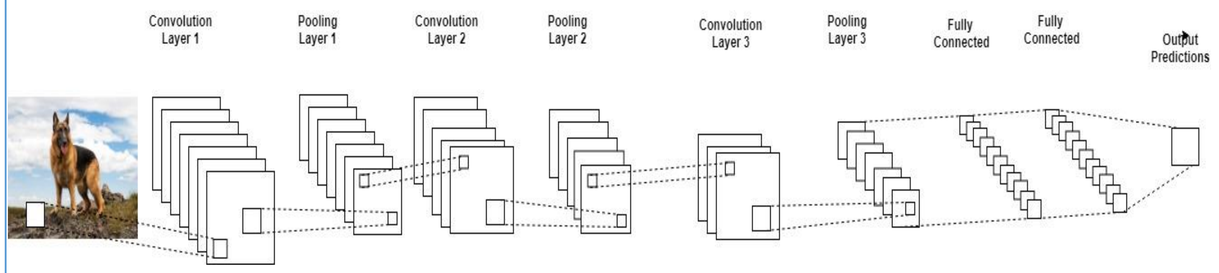
Objectives

- The great variety in dog's breed poses a significant problem to those who interested in identifying the breed of the dog.
- Though it is a classification problem, it's challenging compared to other classification problems as it's a fine-grained classification because of the nature of the dog breeds.
- The difference between different dog breeds is very less and to make it more complex the difference between dogs of same breed is relatively very high.
- This fine-grained nature of dog breeds helps in building a better model which can also be further used to classify other animals to their respective breeds.

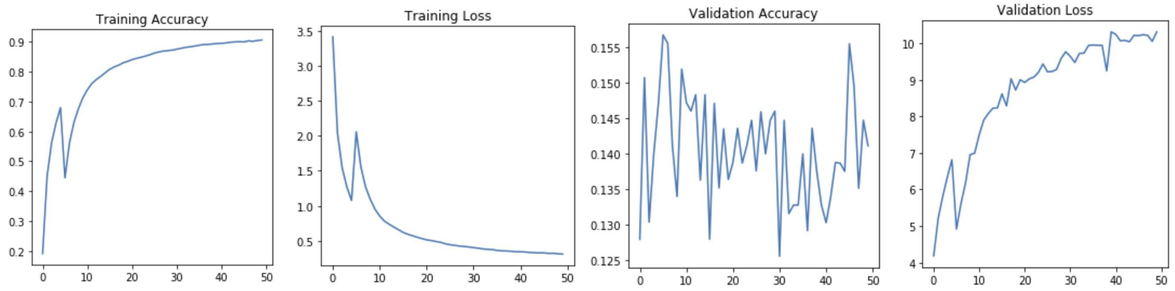
Approach



- We have implemented two CNN models, one acts as a binary classifier which detects if an image is dog or not and the other acts as a multiclass classifier which classifies the image of a dog to it's breed.
- For binary classifier we have used Sequential class from Keras models to build the CNN, we have two layers of convolution each paired with a Pooling layer and then the extracted features are flattened (horizontally stacked) and fed into the dense fully connected layer.
- The binary classifier uses 1 fully connected layer with 128 units and the last layer acts as output layer with just 1 unit. The convolution layer runs a sliding window through the image and at each step convolves the sub image with several filters



- Multi class classifier model is similar to the binary classifier with variations in the number of convolution layers and hidden layers.
- **ReLu** activation function to remove the negative values from the extracted features, **Max-Pooling Layer**, **Adam Optimizer** as optimizer and **Categorical CrossEntropy** as the loss function have been used for the multi class classifier.



Conclusions

- This project proposed a method to classify dog breeds from various dog images by chaining a binary classifier and multiclass classifier.
- Our approach classifies a new data with an accuracy of 14%.
- The accuracy is low due to the fine-grained nature of the images.
- There were also restrictions on the number of features extracted and the convolution and fully connected layers used because they increase the training time significantly (1 extra dense layer almost contributed to a factor of 2 on the training time).
- Even though building CNN from scratch is effective when it consists of ample number of layers, features extracted and is trained sufficiently, the approach is computationally expensive.

Future Work

- The proposed approach, classifier chains, is worth evaluating further as it reduced training times to great extent and allowed the models to be separable and to be reused further.
- The solution can also be used in many other real world scenarios like bio-diversity studies, identifying stray dogs, developing breed specific medicines, classifying birds and other animals.
- The model can be used as a pipeline to a mobile application or a web application.
- A more complex CNN architecture can be built and trained to achieve better performance.